



Predicting the Extent of Tamarisk Habitat on a Quarter Quadrangle Scale

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Abstract:

Tamarisk (*Tamarix spp.*) is an invasive shrub that is native to Eurasia. It was introduced into the United States in the 1800s. By the 1920s tamarisk was becoming a problem (Brotherson and Field, 1987; Di Tomaso, 1998). Since then it has covered almost a million hectares (~2.5 million acres) of the American West. (Pearce and Smith, 2003) occurring mainly in waterways and riparian habitats. We identified potential tamarisk habitat using spatial statistical modeling. Field work identified the presence/absence and percent cover of tamarisk on four different 7.5' topographical maps. Two of these quarter quadrangles were in western Colorado and two were in southern California. We created a model to predict the extent of tamarisk habitat within the selected areas. To test the models we compared the Colorado models to the California models to see if the same variables were significant to the habitat of tamarisk in both locations. We also looked at presence/absence models to determine the area delineated as tamarisk. Tamarisk habitat is found in riparian areas as expected, but tamarisk has not reached its full potential. Habitat information can be used by land managers for early detection, rapid response, and monitoring purposes. Infestations could then be controlled before they expand into large areas.

Key words: spatial modeling, *Tamarix spp.*, invasive weeds

Introduction:

Tamarisk is a fast spreading invasive shrub with a spread rate of about 3-4% per year since the early 1900's (Di Tomaso, 1998). It is difficult to kill mature tamarisk plants due to their long tap root and fire and flood resistance. Early detection is important to the control of newly established tamarisk stands (Kerpez and Smith, 1987), but small infestations are difficult to find. This model shows where tamarisk is most likely to grow. If land managers have an idea of where small invasions may occur they will be able to monitor these areas closely and slow the spread of this shrub.

Objective:

- To provide information about the location of tamarisk to land managers so that when funding is available they will know exactly where to look for invasions.

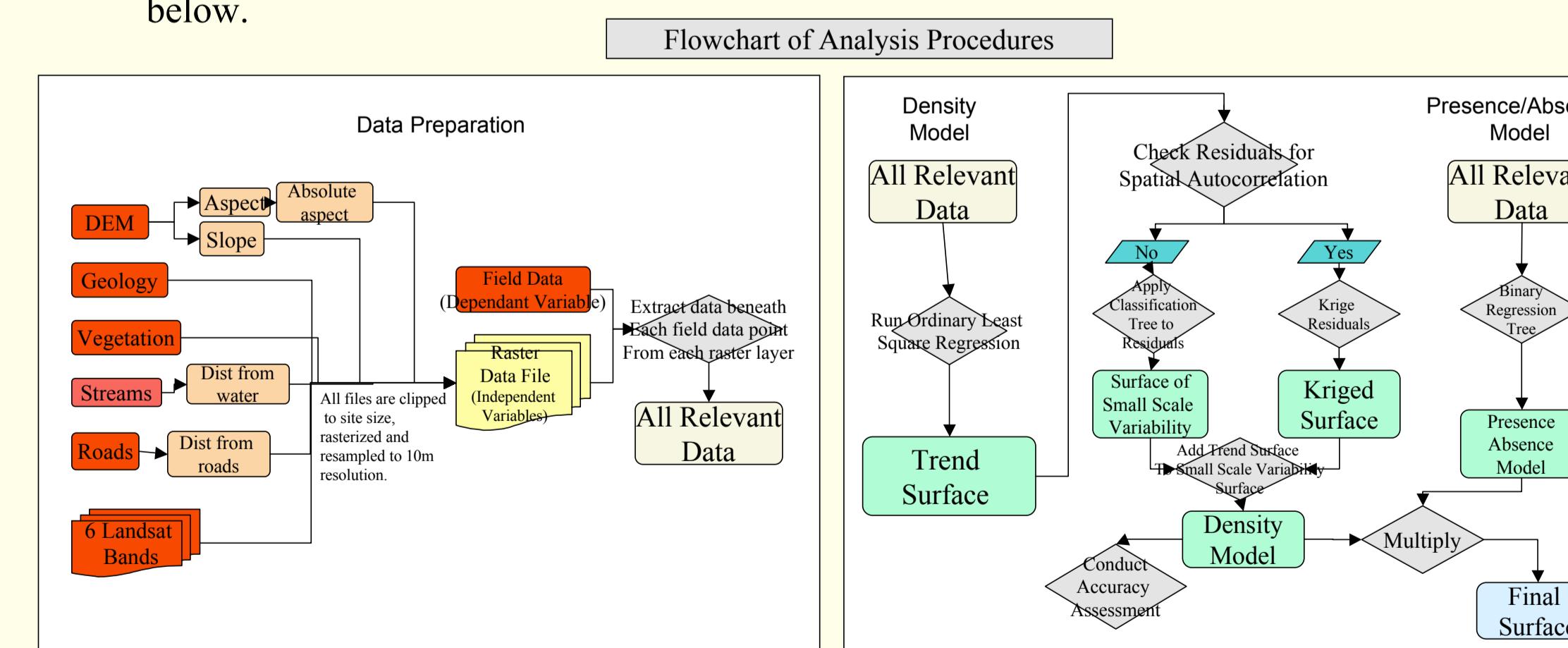
Methods:

Input Data

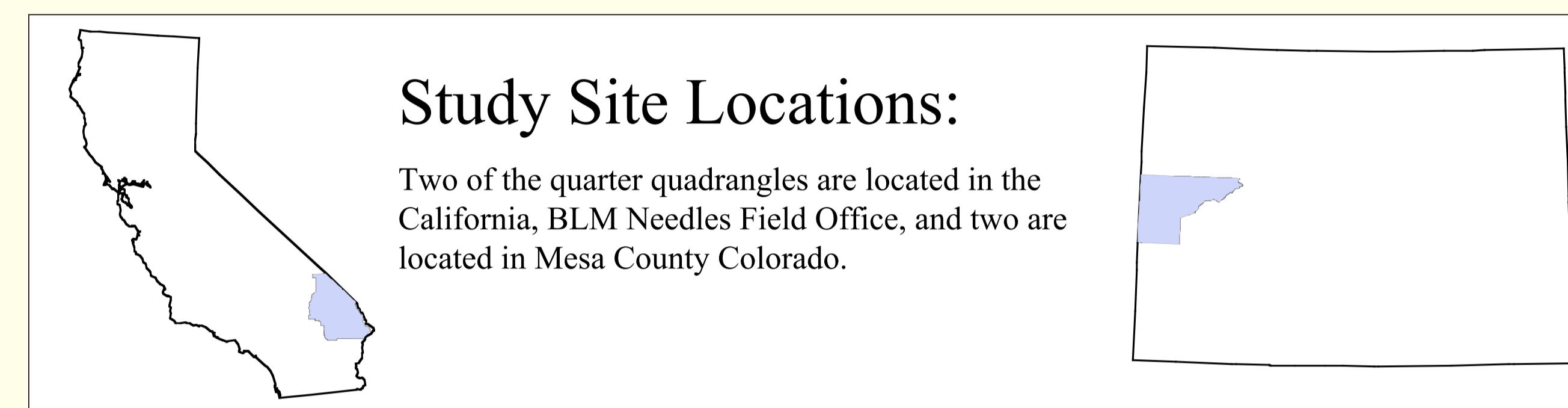
The field data collected is estimated percent cover of vegetation on 30m by 30m plots. This size has been chosen to match the Landsat image resolution. The rest of the information used in the model creation are data sets acquired from the Mojave Desert Ecosystem Program, the BLM of California, and Colorado State University. The data sets that have been included in the model are relative aspect, elevation, slope, distance to roads, distance to water, vegetation, geology and six bands from a Landsat image.

Statistics

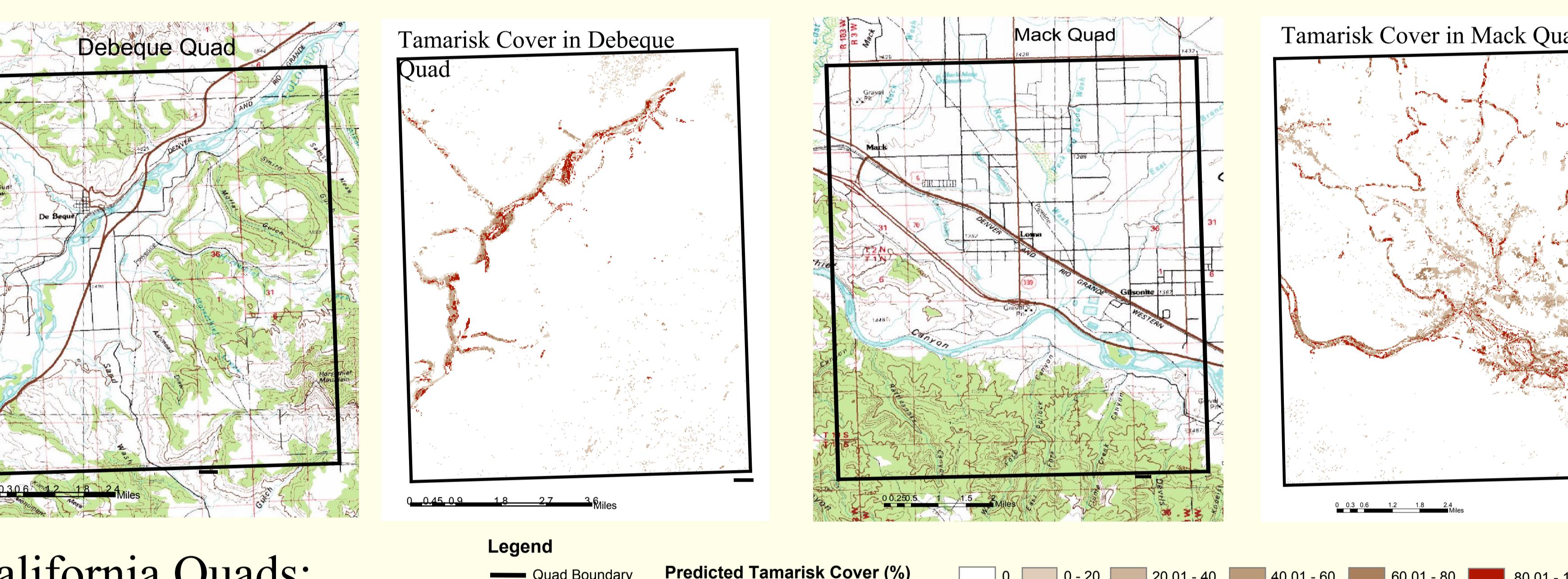
The statistical methods used are outlined in the flowchart below.



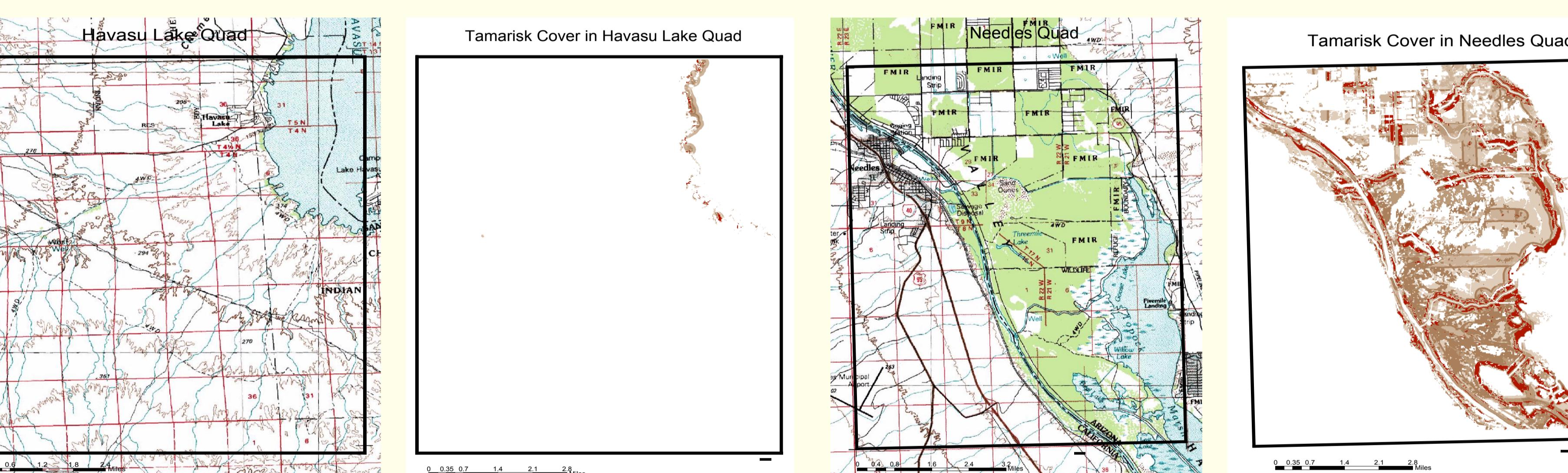
Study Site Locations:



Colorado Quads:



California Quads:



Results:

California

In the presence absence model, the accuracy of absence was 97.9% and the accuracy of presence was 95.1%.

Distance to roads, slope, absolute aspect, elevation and Landsat bands 1, 5, and 7 were selected as significant in describing the large-scale variation of the tamarisk data. Elevation and distance to water were the most important variables in describing the small-scale variation. The trend surface accounted for 39% of the variation in the data and the regression tree accounted for another 49% of the variation, allowing the density model to account for 87.7% of the variation in the data.

Colorado

In the presence absence model, the accuracy of absence was 93.1% and the accuracy of presence was 96.2%.

Distance to water, slope, absolute aspect, elevation, and Landsat bands 1, 2, 4, 5, 7 were selected as significant in describing the large-scale variation of the tamarisk data. Elevation and Landsat band 2 were the most important variables in describing the small-scale variation. The trend surface accounted for 32.5% of the variation in the data and the regression tree accounted for another 47.3% of the variation, allowing the density model to account for 79.8% of the variation in the data.

Conclusions:

1.) Models of plant species invasions must consider small-scale and large-scale drivers. This may be especially important for widely distributed species, since different drivers may affect the establishment and cover of tamarisk in different areas.

2.) Elevation was an important predictor of tamarisk cover in Colorado and California.

3.) This information will allow land managers to assess the vulnerability of sites to invasion, and in surveys for early detection and rapid response.

4.) Future modeling projects will:

- Evaluate where different drivers change across the extent of tamarisk distributions.
- Create a "mosaic" of different models to best predict tamarisk habitat in the western United States.

References:

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